セミナーのご案内

SEMINAR

November 25 (Fri.) 2022, 15:00 ~ 16:00

Lecture Room 4, 303, Science Complex A, Aobayama Campus, School of Science

青葉山北キャンパス理学研究科合同 A 棟[H-02] 303・第 4 講義室

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Interplay of chirality and magnetism – new phenomena at the frontier of physics and chemistry

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Chirality plays a critical role in a wide range of systems, from biology and chemistry to condensed matter physics and high energy physics. For example, in the biochemistry and pharmaceutical industries, enantiomer separation is a major issue, since enantiomers with a specific chirality often have different biochemical properties or pharmacological effects from their counterparts with the opposite chirality. Enantioselectivity is ubiquitous in nature and many of the molecules in plants and living organisms have their properties depending on the type of enantiomer. The importance of chirality was only realized by scientists in the sixties of last century after a disaster with Thalidomide drug used by pregnant women which caused birth of children with malformations due to mutagenic effect of one of the enantiomers. Since then chromatography and electromigration techniques have long been the methods of choice in this field. However, despite intensive efforts, obtaining enantiomerically pure synthetic materials remains a challenge, as the cost of separation is relatively high and an extensive effort is required. In one of our papers [1] we have demonstrated a new effect of magnetization switching of ferromagnetic thin film without applying a magnetic or electric field but being induced solely by adsorption of chiral molecules. The direction of the magnetization depends on the handedness of the adsorbed chiral molecules. Another important result was to propose a new method of enantio-separation based on the interaction of chiral molecules with a perpendicularly magnetized substrate. It was shown that one enantiomer adsorbs preferentially when the magnetic dipole is pointing up, whereas the other adsorbs faster for the opposite magnetization alignment. Moreover the interaction is not controlled by the magnetic field but by the respective electron spin orientations of the ferromagnetic layer and chiral molecules. This method is versatile as it was tested for different kinds of chiral molecules and allows to avoid costly separation columns which has to be designed individually for a given type of chiral molecules used presently in the pharmaceutical industry

[1] O. Ben Dor, S. Yochelis, A. Radko, E. Capua, A. Capua, S. Yang, L. T. Baczewski, S.S.P. Parkin, R. Naaman, Y. Paltiel, Nature Comm. 8, (2017), 14567

[2] K. Banerjee-Ghosh, O. Ben Dor, F. Tassinari, E. Capua, S. Yochelis, A. Capua, See-Hun Yang, S. S. P. Parkin, S. Sarkar, L. Kronik, L. T. Baczewski, R. Naaman, Y. Paltiel,
SCIENCE, Vol. 360, Issue 6395, (2018), 1331

If you will join, please contact the following person

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